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NPIC/D-269-64

23 NOV 1964

MEMORANDUM FOR: Deputy Director of Central Intelligence

THROUGH : Executive Director-Comptroller
Director, Office of Planning, Programming and Budgeting
Deputy Director for Intelligence

SUBJECT : Request for Approval of Rear-Projection Viewer Project [redacted] from FY 1967 Funding

25X1

REFERENCE : Chief, Administrative Staff, O/DDI Memorandum of 4 February 1964 on: "Approval of R&D Activities."

1. The Rear-Projection Viewer Project is ready for contract negotiation. The project will provide for a greatly improved viewer to allow the P.I. to obtain more information from aerial photography than is possible with existing rear-projection viewers.

2. The attached staff study, tab, and contract proposal present the complete schedule, plans, and justification for the project.

3. It is recommended that this project be approved at a funding level [redacted]

25X1

[redacted]

25X1

ARTHUR C. LUNDAHL
Director
National Photographic Interpretation Center

Attachments: a/s

APPROVED: _____ _____
R. J. SMITH (Date)
Deputy Director for Intelligence

_____ _____
RUFUS TAYLOR (Date)
Vice Admiral, U.S. Navy
Deputy Director of Central Intelligence

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NPIC/D-269-66

SUBJECT: Request for Approval of Rear-Projection Viewer Project with [redacted] from FY 1967 funding. 25X1

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24 October 1966

REAR-PROJECTION VIEWER
(#02157)

1. PROBLEM.

To provide NPIC with a viewing device whose performance characteristics are commensurate with the large quantities and high quality of current and projected imagery inputs.

2. FACTS BEARING ON THE PROBLEM.

a. The basic purpose of the rear-projection viewer in the photo interpretation process is to provide large area display of imagery. This viewer would be more efficient in rapid information transfer than are the small area displays of direct viewing systems.

b. In spite of this advantage, rear-projection viewers have been practically eliminated from photo interpretation scanning operations because of the deficiencies of existing viewers.

c. Recent improvements in the critical components of rear-projection systems indicate that a new viewer with significantly improved performance could be developed.

d. The potential for increased operator efficiency justifies the development of an advanced rear-projection viewer.

3. DISCUSSION.

a. Current Procedure. Until recently, rear-projection viewers were widely used in scanning and searching operations because of their extremely rapid presentation of large areas. However, these operations now depend solely on direct viewing systems because increases in image quality have surpassed the performance characteristics of available rear-projection viewers. Since the area of the field of view of a rear-projection system is typically about 14 times that of a direct viewing system at the same magnification, the use of direct viewing systems is slower and normally less efficient.

b. Origin of Concept. Rear-projection viewing has been proven through years of operational use to be an efficient method for rapidly scanning and searching reconnaissance imagery. The method has recently fallen into disuse because of the danger of information loss through image degradation by available rear-projection viewers. Now, however, recently proven components and concepts, such as improved heat filtering, xenon arc lamps, new zoom lens systems, automatic focusing, and semi-automatic film loading, make it possible to develop an advanced rear-projection viewer without the deficiencies of earlier models.

Proposed Program. This project will result in the fabrication of a prototype advanced rear-projection viewer. The viewer will incorporate the following characteristics:

1. Resolution - The resolution capabilities of the system will be 30 line pairs/millimeter (lp/mm) @ 3X and 420 lp/mm @ 70X, measured at the film gate. The resolution, as measured in line pairs per millimeter per magnification power (lp/mm/mag), will decrease linearly from 10 lp/mm/mag @ 3X to 6 lp/mm/mag @ 70X, at the screen. These values will not vary by more than 20% over the entire screen.

2. Magnification.- The system will have continuous (Zoom) magnification in two stages, from 3X to 30X and from 25X to 70X. The changeover time from one range to the other will require approximately five seconds. When changed from the low to the high magnification range, the system will automatically position at 25X, the lowest magnification of the high range.

25X1

[redacted] optically compensated zoom lens system is superior to a fixed focal length, mechanically compensated zoom system because of the overall mechanical simplicity of the system. The overall distance between the film and the screen remains constant, thus allowing the zoom system to be packaged into a smaller physical configuration. To achieve a comparable fixed focal length zoom system, at least three zoom ranges would be required. The optically compensated system overcomes this restriction by changing the focal length of the optical system. This is compatible with the relatively large field requirements at low magnification and the high numerical aperture (resolution) at high magnification.

3. Film Capacity.- The viewer will accommodate 1,000 foot rolls of all film widths from 70mm to 9.5 inches.

4. Semi-automatic Film Loading - The viewer will employ a semi-automatic film loading system. The operator will merely load the film spool in the transport and attach the end of the film to a carrier which will automatically transport the film through the projection platen and onto the take-up reel. The take-up reel will be a permanent device, but will accommodate various film widths. The mid-point of all the various film widths will always be positioned at mid-point of the film projection gate.

5. Screen Brightness - The screen brightness, as viewed from the position of the observer, will have a minimum luminance of 20 foot-lamberts at any magnification measured with 1.5 neutral density filmfilling the film plane (open gate screen brightness will be 630 foot-lamberts). Screen illumination will at no point vary more than 10%. The light intensity will be continuously variable from 100% to 50% of the above specified values. The color temperature of the illumination will never fall below 3400°K and the intensity of the lamp will not diminish by more than 10% during the first 1,000 hours of operation.

The above parameters will be accomplished by using a 2,500 watt xenon arc lamp in conjunction with a mosaic condenser system whose individual mosaic elements act to distribute the light flux across the entire film gate. This system, which has proven to be satisfactory in past developments, employs two arrays of mosaic lenses. The first array intercepts the rays from the condensing optics and forms multiple images of the xenon source on the second array. Each lens of the second mosaic structure reimages each individual aperture of the first array over the entire film plane. A field lens adjacent to the film plane redirects the diverging rays to fill the exit pupil of the projection system throughout its magnification range.

The xenon arc was selected because it radiates a continuum through the visual spectrum which very closely matches that of a 6,000°K black body. This lamp requires no warm-up period and its luminous output can be varied without significantly changing the spectral content.

6. Film Temperature - The maximum film temperature of a silver halide film with a fogged density of 1.5 completely filling the gate with the light source burning continuously at maximum brightness for three hours will be 100°F operating in an ambient temperature of 80° or below. [redacted] has previously built a successful system using a "cold" mirror which reflects the visual energy on to the film and transmits the infrared radiation out of the optical path into a heat sink. In addition, heat absorbing filters will be placed between the lamp and the film gate. 25X1

7. Automatic Film Focus - The imagery will automatically be in focus at any magnification, either in the static viewing or the transport mode, but not in the high speed slew mode; however, the entire projected image will remain in sharp focus during scan of the film at a selected rate commensurate with the magnification.

A focus adjustment is provided for emulsion up or down variations or initial loading conditions. There will be no damage to the film either in the static or dynamic conditions.

8. Distortion - The optical system will be so designed that when the image is in sharp focus there will be no apparent color fringing on the screen. The geometrical distortion at the screen will not exceed 2%.

9. Additional Features - Some features that are incorporated on present rear-projection viewers will be retained. These include optical image motion which directly corresponds to

the direction and magnitude of joystick deflection. The viewer will have a Polacoat LS-60 screen, which has proven to be the best compromise for the various viewing conditions.

The structure of the unit will be of the "space frame" type, incorporating all of the primary support and alignment functions into a one-piece unit. The overall size of the viewer will be 74 inches high, 84 inches deep, and 36 inches wide. The power and cooling module will be 36 inches high, 29 inches deep, and 44 inches wide.

d. Selection of Contractor. Eighteen companies were invited to bid on this project. Six companies submitted proposals, and the [redacted] 25X1
25X1 [redacted] proposal was competitively judged to be the best. This firm submitted the lowest bid and demonstrated technical competence in its proposal.

e. Program Phasing. The contractor will fabricate and deliver the prototype advanced rear-projection viewer within 11 months of the date of the contract. Since most of the basic design of this device is already accomplished and this is a fixed price contract, no specific phasing is contemplated.

f. Coordination. Internal and external coordination is being maintained to insure that there is no duplication of effort within the Agency or the Intelligence Community. Specifically, representatives of the Naval Air Systems Command, Rome Air Development Center, and the Geodesy Intelligence Mapping Research and Development Agency maintain that no effort within their responsibility duplicates this project.

g. Alternatives. The alternative to this project is continuation of the present direct viewing operation, which is relatively inefficient for scanning and searching very large volumes of material. It is anticipated that the sheer volume of input from future collection systems will preclude total reliance on direct viewing because of the prohibitive manpower requirements.

4. CONCLUSIONS.

The advanced rear-projection viewer promises to increase the efficiency of certain operations with the National Photographic Interpretation Center. Since the work load at the Center is steadily increasing, the efficiency of its operation must be increased.

5. RECOMMENDATIONS.

It is recommended that approval be granted to contract with [redacted] 25X1
25X1 [redacted] for this development at a funding level of [redacted] 25X1

6. REFERENCES AND ATTACHMENTS.

TAB A - Catalog Form

25X1 Attachment: [redacted] Proposal 9965-3302, dated December 1965.

SECRET
(When Filled In)

TAB A

R & D CATALOG FORM

DATE: 21 October 1966

1. PROJECT TITLE/CODE NAME: Rear-Projection Viewer

2. SHORT PROJECT DESCRIPTION: An advanced rear-projection viewer that will increase the rate of information transfer between the imagery and the photo interpreter.

3. CONTRACTOR NAME

25X1

4. LOCATION OF CONTRACTOR

2

5. CLASS OF CONTRACTOR: Manufacturer

6. TYPE OF CONTRACT: Fixed Price

7. FUNDS

FY 1966 $ None

25X1 FY 1967 $

FY 1968 $ None

8. REQUISITION NO.

9. BUDGET PROJECT NO.: NP-V-15-02157

10. EFFECTIVE CONTRACT DATE (Begin - end): January 1967 - January 1968

11. SECURITY CLASS.: A.A.-Confidential T.-Unclassified W.-Unclassified

12. RESPONSIBLE DIRECTORATE/OFFICE/PROJECT OFFICER TELEPHONE EXTENSION

25X1 DDI/NPIC/P&DS/

13. REQUIREMENT/AUTHORITY: The image quality of acquisition materials is improving so rapidly that existing rear-projection viewers will not display it to its best advantage. This development will be an improvement of the illumination, film transport, and lens systems in rear-projection viewers.

14. TYPE OF WORK TO BE DONE: Engineering Development

15. CATEGORIES OF EFFORT

MAJOR CATEGORY	SUB-CATEGORIES
Rear-Projection Viewing Systems	Visual
	Interpretation/Analysis

16. END ITEM OR SERVICES FROM THIS CONTRACT/IMPROVEMENT OVER CURRENT SYSTEM, EQUIPMENT, ETC.

This contract will provide for the development of a new and higher performance rear-projection system. The scope of this development will be the design and fabrication of an operational, prototype, advanced rear-projection viewer.

17. SUPPORTING OR RELATED CONTRACTS (Agency & Other)/COORDINATION

There is no known equipment either under development or available commercially which will satisfy this requirement. This project has been coordinated with DDS&T/ORD, disseminated to the intelligence community through the 1966 NPIC Equipment Summary, and presented to the Committee on Photographic Exploitation.

18. DESCRIPTION OF INTELLIGENCE REQUIREMENT AND DETAILED TECHNICAL DESCRIPTION OF PROJECT (Continue on additional page if required)

This development will allow the photo interpreter to obtain more information from aerial photography than is possible with existing rear-projection viewers and will also provide more flexibility in the overall scanning operation.

19. APPROVED BY AND DATE

OFFICE	DEPUTY DIRECTOR	DDCI